

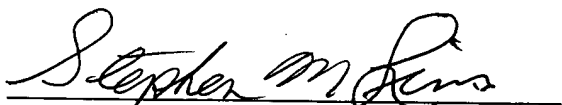
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## CERTIFICATION

I, Stephen M. Lins, maintaining my place of business at the address shown above, herewith certify that the accompanying English text is a true and correct translation of the corresponding German language document:

### ***Europäische Patentanmeldung EP 0 311 828 A2***

I additionally attest that I have knowledge of both the German and English languages, and that I am further qualified by education, experience and vocation to issue this certification. I affirm under the penalty of perjury under the laws of the United States that the foregoing is correct to the best of my information and belief.



Stephen M. Lins

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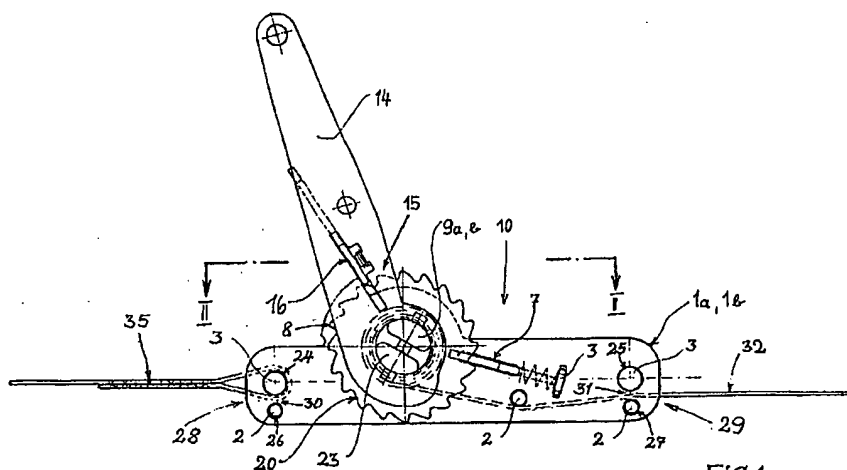
**RATCHET FOR TIGHTENING, ESPECIALLY OF LASHING STRAPS**

(57)

The invention relates to a ratchet for tightening, especially of lashing straps, with a frame part having a pair of side pieces arranged normally spaced-apart at both sides of a bridge element formed as one piece with the side pieces, which side pieces have bores for the rotationally-movable support of a strap windup shaft with a slot, which strap windup shaft work together with, on the one hand, a swingable drive hand-lever and, on the other hand, with ratchet wheel lock, wherein each support bore is formed at the top and toward the outside with a divided-circle shaped guide link for a pawl that is displaceably arranged in the drive hand-lever, and in the frame part a likewise displaceably-arranged reverse-motion locking pawl is present,

**characterized in that,**

the side pieces (1a, 1b) are connected fixedly to each other at the frame part (10) without arrangement of the single-piece bridge element, but rather through at least two space-retaining elements (2, 3) formed as multiple pieces with the side pieces (1a, 1b).

**FIG.1****EP 0 311 828 A2**

## **RATCHET FOR TIGHTENING, ESPECIALLY OF LASHING STRAPS**

The invention relates to a ratchet for tightening, especially of lashing straps, with a frame part having a pair of side pieces arranged normally spaced-apart at both sides of a bridge element formed as one piece with the side pieces, which side pieces have bores for the rotationally-movable support of a strap-winding shaft with a slot, which shaft works together with, on the one hand, a swingable actuating hand-lever, and on the other hand, with a ratchet wheel catch, wherein each support bore is formed at the top and toward the outside with a divided-circle shaped guide link for a pawl displaceably arranged in the actuating hand-lever, and in the frame part a likewise displaceably-arranged reverse-motion locking pawl is present.

A ratchet of the type specified above is referred to as a tension lock for belt straps.

A tensioning device or ratchet or tension lock of the above-stated type is known, for example, from US Patent Specification 4,199,182.

In the known device, a locking member is associated with the locking teeth of the ratchet wheel, which locking member consists of a single locking pawl. The number of the teeth on ratchet wheels, as is learned from this publication, is limited for reasons of strength. They normally amount to 11 (eleven) and thus correspond to a tooth distribution with an angle of approximately  $33^{\circ}$ .

A distribution angle of this size prevents, in many cases, the actual attaining of the greatest possible tensioning force in the lashing strap through actuation by means of the hand power of the hand lever arranged as the driving organ, because in order to engage the locking pawl with the most remote reachable locking tooth of the ratchet wheel, it would still be necessary to carry out a movement step that far exceeds the available hand power of the user. Here, then, only a tooth that stands further back in the drive-rotation direction can be engaged, and in the most unfavorable case a slackening of the ratchet wheel and thus of the achievable strap tension through the winding shaft occurs, up to approximately the movement step of one tooth angle. The maximally achievable tension moment is thus not even close to being attained.

A tensioning device of the type stated at the beginning is further known from DE-PS

32 03 750.

In this known device, as well as in a multitude of similar ratchets and tension locks known in the prior art and commercially available, the tension lock consists of a frame in the form of a U-shape-canted profiled sheet metal with a relatively short base and two U-legs projecting beyond this base forward and backward, into one end of which a crosspiece or bolt is inserted via aligned bores, which crosspiece or bolt, normally with an intermediate layer of a small tube spacer, connects the legs to each other via a screw connection or a riveted joint in a spaced apart, parallel manner.

In the known strap ratchets or tension locks, this bolt forms at one end of the frame a strap connection for a strap end assembled with a loop.

At the other end, the frame formed with a U-shaped bridge is then provided with aligning support bores for the slotted strap wind-up shaft, into which a loop-free strap end is inserted and, through winding onto the the winding shaft, is first fastened and subsequently tightened.

Disadvantageous in this generally conventional design that is established as standard in practice is the fact that the clamping direction of the ratchet in the strap path is fixed in the above-mentioned arrangement of the strap connections in such a way that in each case the loop-free strap end must be connected to the to the end of the frame having the winding shaft and the strap end provided with a loop must be connected to the opposite end of the frame. A reversal of the ratchet body is thus not possible with the known design of the ratchet.

Thus, the case can arise in which, during the lashing down of a parcel, the driving lever, working together with the ratchet-wheel lock, is located in an unfavorable position. This is because, depending on the position in which the lashing means, strap, their catch point on the vehicle, and the ratchet are situated in relation to, on the one hand, the position of the good to be lashed, and on the other hand, to the position of the operating person, this person, for example standing at street level, can actuate the ratchet better, with respect to ergonomics, through pulling down with raised hands while standing, the ratchet being above head level on the vehicle, or, for example, standing on the pallet, can actuate the ratchet better in an

ergonomic respect through pulling the lever up from a bent-torso position.

Consequently, the use of a ratchet that is non-reversible in its association with the different strap ends necessarily leads to ergonomically unfavorable situations. Through this, considerable problems can arise during the lashing down, since the necessary lashing tension is not achieved.

Starting from the named prior art, the invention is based on the task of improving a ratchet of the type in question in such a way that it makes possible, in all occurring application cases, an ergonomically optimal actuation in order to achieve the greatest possible tension force, through being attachable to the strap ends in a selective manner in each case, such that an actuation can always be carried out, to the greatest possible extent, through application of the full body weight.

Further, the achievement of the highest possible tension forces should also be additionally improved through the fact that, instead of the hitherto usual tooth distribution angle of approximately  $33^\circ$ , a substantially smaller tooth distribution angle in the ratchet wheel lock is made possible, without thereby reducing the necessary strength and/or reliability of the lock.

Finally, the invention aims at an arrangement of the device that is as uncomplicated as possible, which device should preferably be suitable in a special manner for economical production from stampings even for relatively small to medium serial-piece numbers.

With the invention, the solution of the stated task is successful, in the case of a ratchet, of the type named in the preamble, for tightening, especially of lashing straps, through the fact that the side pieces, with arrangement of the one-piece bridge element, are fixedly connected to each other at the frame part through at least two multipiece space-retaining elements.

Advantageously, through the elimination of the bridge element between the side pieces, generally standard in the prior art, as well as through the connection of the side pieces through multipiece space-retaining elements, the accessibility of the insertion slot of the strap winding shaft is substantially improved, and this in such a

way that a loop-free end can be inserted without difficulty into the slot of the winding shaft from each of the two ends of the frame part or rather of the side pieces.

Thus, for the first time the invention offers the possibility of connecting the strap ratchet between a loop-free strap end and a strap end with a loop in every case independently of the arrangement of the ratchet, in such a way that the actuating lever, in cooperation with the ratchet wheel lock, is available in an ergonomically favorable position that allows the user to use his full body weight, in addition to his muscle power, during the actuation of the actuating lever.

However, the elimination of the usual bridge element between the side pieces, present in the prior art, also results in a significant reduction of the tool expense necessary in the production for the corresponding stampings. For example, now necessary for the design of the frame part according to the invention are two identical stampings that can be stamped out of strip stock with relatively little material waste. With the reduction of the blank surface, however, not only does the tool become smaller and thus more economical, but also the cutting pressure is reduced and thus a substantially smaller stamping press is needed, the operating costs of which are likewise lower. At the same time, such smaller presses operate with a comparatively very much quicker work cycle, so that for that reason too the production costs are reduced.

Thus, through the design according to the invention, in addition to the improvement in the application area, production costs are saved and the possibility arises of a very economical manufacturing even in the case of small or medium production-lot sizes.

Further improvements of the inventive object result from embodiments in detail corresponding to the features of claims 2 through 11.

Here, for the free choice of the clamping direction of the ratchet between two strap ends with different end equipment, it is of essential importance to the invention that the side pieces display connection bolts at both ends, as well as that underneath each of the connection bolts is arranged in each case a second bolt, forming a guide slot for the strap, the second bolt being spaced apart in a parallel manner.

Further, of essential advantage to the invention, in cooperation with the above-stated features, is the design of the ratchet wheel of the ratchet wheel lock, in which the diameter ratio of the shell circle to the root circle of the teeth is between 1.1 and 1.2, preferably 1.16666.

Through this means it becomes possible for the angular distance from tooth to tooth to be between 15 and 18 angular degrees, whereas this distance, as mentioned, is usually approximately  $33^{\circ}$  in the case of the prior art.

This narrower tooth distribution is made possible through an increase in the number of teeth to 24 or 20 teeth, as the case may be, in the ratchet wheel, and this in turn through an increase of the ratchet wheel diameter, which is achieved through the fact that, according to claim 9 of the inventive object, the center point of the support bore of the winding-shaft support is arranged on a line x-x that runs at substantially the height of the top edge of the side piece.

A further improvement essential to the invention is achieved according to claim 10 through the fact that the guide link, which normally displays at one end of its divided-circle shaped form a catch recess for fixing the actuating hand-lever in the neutral position when the lock of the winding shaft is released by means of the pawl, according to the invention displays also at the other end of its divided-circle shaped form a second catch recess for fixing the actuating hand-lever in its actuating end-position.

Through this means, the hand lever can be fixedly engaged in either of its end positions, which, in consideration of the reversibility of the ratchet in the strap running direction achievable with the invention, is especially advantageous.

The invention is shown in schematic drawings in a preferred embodiment form, and further advantageous details of the invention can be learned from the drawings.

The drawings show in detail:

- Fig. 1: a ratchet in side view;
- Fig. 2: the ratchet according to Fig. 1 in plan view of a plane II-II in Fig. 1;
- Fig. 3: a side view of a side piece of a ratchet according to Fig. 1;

Fig. 4: a ratchet wheel of a ratchet according to Fig. 1, in side view.

The ratchet, represented in Fig. 1 in side view, for tightening of lashing straps displays a frame part 10, which is formed substantially of a pair of side pieces 1a, 1b arranged in a spaced-apart manner. These side pieces display bores 9a, 9b for the rotationally-movable support of a strap winding shaft 23 as well as of a actuating hand-lever 14 that is in turn supported on this shaft 23.

Working together with the strap winding shaft 23 is a ratchet wheel lock 15, which includes a ratchet wheel 20 and a pawl 16 arranged displaceably in the actuating hand-lever 14, as well as a reverse-motion locking pawl 7 likewise arranged displaceably in the frame part 10.

The bores 9a, 9b are formed at the top and toward the outside with a divided-circle shaped guide link 12a, 12b for the pawl 16 that is displaceably arranged in the actuating hand-lever 14.

Whereas in the prior art – as mentioned – it is conventional and has become generally established to connect the two side pieces 1a, 1b of the frame part 10 of a ratchet in a U-shaped manner through a bridge element formed as a single-piece with the side pieces, in deviation from this standard structure the inventive object is designed such that the side walls 1a, 1b are fixedly connected to each other on the frame part 10 without arrangement of a single-piece bridge element of this type, but rather by means of at least two space-retaining elements 2, 3 formed as multiple pieces with the side walls 1a, 1b.

As can be learned from a viewing together of Figs. 1 and 3, as a consequence of the elimination of the bridge element the side pieces 1a, 1b are designed in an especially uncomplicated manner in their shaping, and consist essentially of strip-shaped lower formed part 33 with the guide link 12a, 12b enclosing the bore 9a, 9a in a one-piece manner at the top.

Also as a consequence of the absence of the bridge element between the side pieces 1a, 1b, the diameter of the ratchet-wheel shell circle can now be designed considerably larger than it can be in the known ratchets.

Thus, for example, the diameter of the shell circle 20 (Fig. 4) corresponds to double the width ( $= 2B$ ) of the strip-shaped formed part 33 of a side piece 1a, 1b.

A further serious and thus invention-essential advantage results also from the elimination of a bridge element in that, in accordance with the representation in Fig. 1, a loop-free strap end 32 can now be inserted into the ratchet also from the side of the frame part 10 displaying the reverse-motion locking pawl 7 and can be rolled up around the strap winding shaft 23 after insertion into the slot of the latter.

This was, for practical purposes, impossible until now with the presence of a U-shaped bridge element between the side pieces 1a, 1b of the frame part 10.

In an embodiment, the space-retaining elements 2, 3 are fastened to the side pieces 1a, 1b by means of rivet connections 4, 5.

However, this is not to exclude the fact that some of these space-retaining elements, e.g. 3, can be designed as threaded bolts with space retainers, such as small tubes, inserted between the side pieces 1a, 1b.

Further, in an embodiment essential to the invention the side pieces 1a, 1b display connection bolts 24, 25 at both ends 28, 29.

This measure also serves to allow the insertion, according to choice, of a loop-free strap end 32 from either of the two ends 28, 29 of the ratchet into the latter and the connection to the opposite end, in each case, of the strap end 35 having the loop, or vice versa.

Further, in an embodiment under each of the connection bolts 24, 25 is arranged in each case a second, thinner bolt 26, 27, forming in each case a guide slot 30, 31 for the strap ends 32 and 35, this second bolt being arranged in a parallel, spaced-apart manner.

This measure also serves to allow the free choice of the strap end 32 or 35 to be inserted from the right (e.g. Fig. 1) or likewise from the left, or vice versa.

Here, in each case the connection bolt 24, 25 is appropriately substantially larger in diameter than the second bolt 26, 27, and arranged in approximately the center

region of the width "B" of the side piece 1a, 1b, while the second bolts 26, 27 are arranged in the lower region of the side pieces 1a, 1b.

Further, in an embodiment a space-retaining element 3 is designed with a guide 6 for the reverse-motion locking pawl 7 that is displaceably arranged in the frame part 10.

Further, in an embodiment essential to the invention, in which the ratchet wheel 20 of the ratchet wheel lock 15 is formed with unidirectional teeth 8, the diameter ratio of the shell circle 21 to the root circle 22 of the teeth 8 amounts to between 1.1 and 1.2, and preferably 1.16666. From this results an angular distance between two neighboring teeth 8a, 8b, in each case, of between  $15^{\circ}$  and  $18^{\circ}$  (Fig. 4).

Further, the center point "M" of the bores 9a, 9b for supporting the strap winding shaft 23 is advantageously arranged on a line x-x (Fig. 3) that runs substantially at the level of the top edge 11 of the side pieces 1a, 1b.

As a consequence of the arrangement thus made, the ratchet wheel 20 can have a diameter that is substantially larger, in relation to the height of the ratchet, than was usual or possible until now in the known ratchets.

From this results in addition the advantage essential to the invention that, through the increased number of teeth 8a, 8b, etc. with a relatively unchanged tooth shape and depth, the angular distance from tooth to tooth 8a, 8b can be reduced to  $18^{\circ}$  or  $15^{\circ}$ , as the case may be, from the approximately  $33^{\circ}$  in the known designs of ratchets, and this without the additional expense of, for example, a known double ratchet wheel lock. Resulting from this is the possibility, in a ratchet of uncomplicated design, of an optimal tightening power in the use of the ratchet

In a further embodiment, wherein the guide link 12a, 12b displays at one end 18 of its divided-circle shaped embodiment a catch recess 13 for fixing the actuating hand-lever 14 in the neutral position when the lock 15 of the strap winding shaft 23 is released by means of the pawl 16 that can be engaged in the catch recess 13, the guide link 12a, 12b displays at the other end 19 of its divided-circle shaped embodiment a second catch recess 17 for fixing the actuating hand-lever 14 in its

actuating end-position.

Through this means, the hand-lever 14 can be locked fast in each of its end positions, which, in consideration of the directional reversal of the ratchet in the strap running direction possible according to the invention, is an essential advantage and increases the security, for example during transport.

The ratchet according to the invention is uncomplicated in structure, is reversible in the direction of connection at will, and makes possible, as a consequence of the special embodiment of the ratchet wheel and its distribution of teeth, an optimal utilization of the actuation force in the ergonomically best conditions.

To this extent, an ideal solution of the task stated at the beginning can be spoken of.

**REFERENCE NUMERAL LIST**

1. side pieces
2. space retainer
3. space retainer
4. rivet connection
5. rivet connection
6. guide
7. reverse-motion locking pawl
8. tooth
9. bore
10. frame part
11. top edge
12. guide link
13. catch recess (first)
14. actuating hand-lever
15. lock
16. pawl
17. catch recess (second)
18. one end of the link
19. other end of the link
20. ratchet wheel
21. shell circle
22. root circle
23. strap winding shaft
24. bolt
25. bolt
26. second bolt
27. second bolt
28. one end
29. other end
30. guide slot
31. guide slot

- 32. strap
- 33. strip-shaped formed part
- 34. tube part
- 35. strap end



**CLAIMS**

1. Ratchet for tightening, especially of lashing straps, with a frame part having a pair of side pieces arranged normally spaced-apart at both sides of a bridge element formed as one piece with the side pieces, which side pieces have bores for the rotationally-movable support of a strap winding shaft with a slot, which strap winding shaft works together with, on the one hand, a swingable actuating hand-lever and, on the other hand, with a ratchet wheel lock, wherein each support bore is formed at the top and toward the outside with a divided-circle shaped guide link for a pawl that is displaceably arranged in the actuating hand-lever, and in the frame part a likewise displaceably-arranged reverse-motion locking pawl is present,  
**characterized in that**  
the side pieces (1a, 1b) are connected fixedly to each other at the frame part (10) without arrangement of the single-piece bridge element, but rather through at least two space-retaining elements (2, 3) formed as multiple pieces with the side pieces (1a, 1b).
2. Ratchet according to claim 1, characterized in that the space-retaining elements (2, 3) are attached to the side pieces (1a, 1b) by means of rivet connections (4, 5).
3. Ratchet according to claims 1 and 2, characterized in that the side pieces (1a, 1b) display connection bolts (24, 25) at both ends (28, 29).
4. Ratchet according to one of the claims 1 through 3, characterized in that underneath each of the connection bolts (24, 25) is arranged in each case a second bolt (26, 27), forming a guide slot (30, 31) for the strap (32), said arranging being in a parallel, spaced-apart manner.
5. Ratchet according to one of the claims 1 through 4, characterized in that the connection bolts (24, 25) are substantially larger in diameter than the second bolts (26, 27) and are arranged approximately in the region of the central breadth of the side pieces (1a, 1b), and the second bolts (26, 27) are arranged

in the lower region of the side pieces.

6. Ratchet according to claims 1 and 2, characterized in that a space-retaining element (3) is designed with a guide (6) for the reverse-motion locking pawl (7) that is displaceably arranged in the frame part (10).
7. Ratchet according to one of the claims 1 through 6, wherein the ratchet wheel (20) of the ratchet wheel lock (15) is designed with unidirectional teeth (8), characterized in that the diameter ratio of the shell circle (21) to the root circle (22) of the teeth (8) is between 1.1 and 1.2, and preferably 1.16666.
8. Ratchet according to one of the claims 1 through 7, characterized in that the angular distance between two neighboring teeth (8a, 8b) in each case is between 15 and 18 angular degrees.
9. Ratchet according to one of the claims 1 through 8, characterized in that the center point (M) of the bore (9a, 9b) is arranged on a line (x-x) that runs substantially at the level of the top edge (11) of the side piece (1a, 1b).
10. Ratchet according to one of the claims 1 through 9, wherein the guide link (12) displays at one end (18) of its divided-circle shaped embodiment a catch recess (13) for fixing the actuating hand-lever (14) in the neutral position when the lock (15) of the strap winding shaft (23) is released by means of the pawl (16) that can be engaged in the catch recess (13), characterized in that the guide link (12) displays at the other end (19) of its divided-circle shaped embodiment a second catch recess (17) for fixing the actuating hand-lever (14) in its actuating end-position.
11. Ratchet according to one of the claims 1 through 10, characterized in that the diameter of the shell circle (21) of the ratchet wheel (20) is double the width (2 x B) of a side piece (1a, 1b).

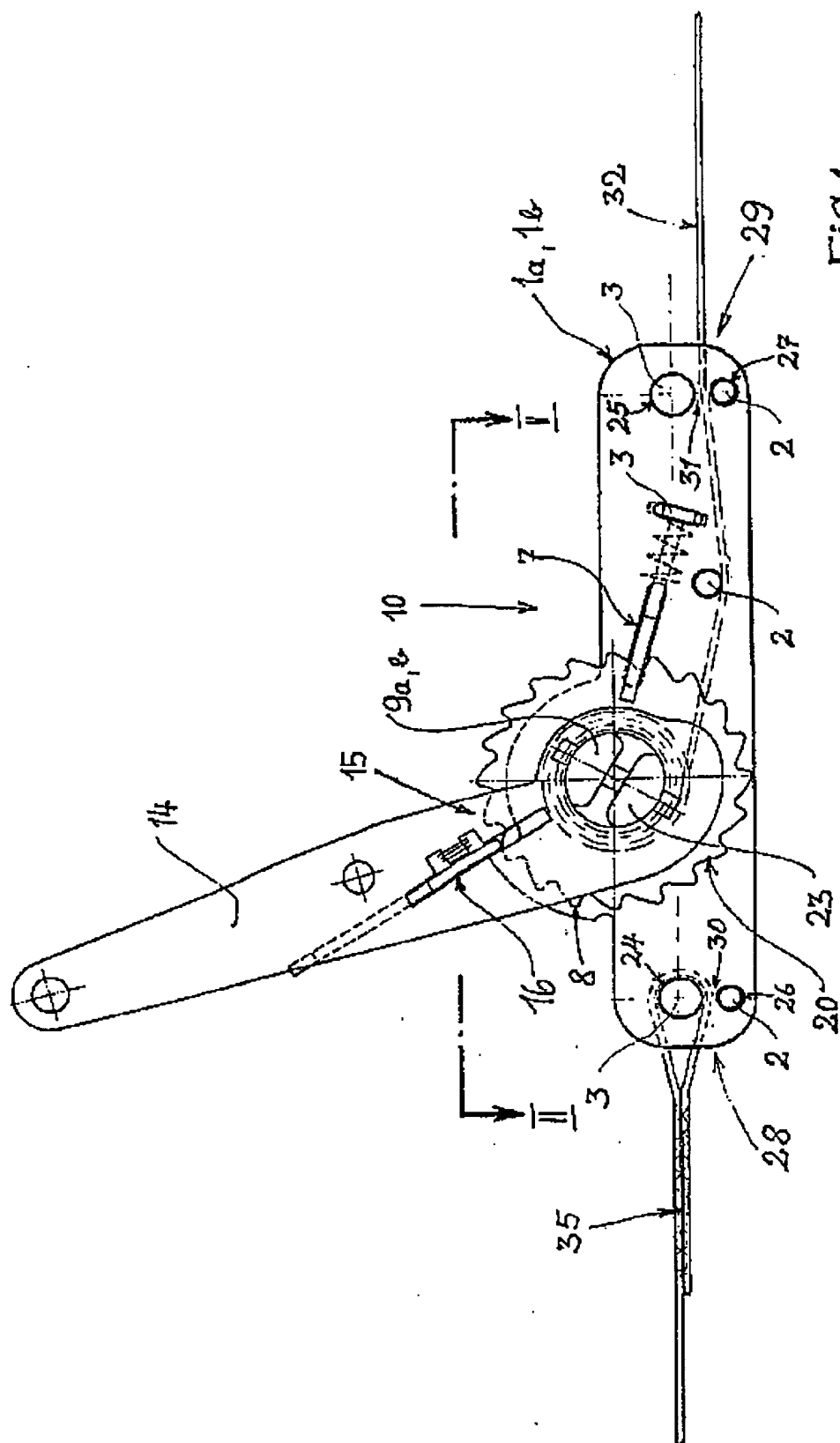
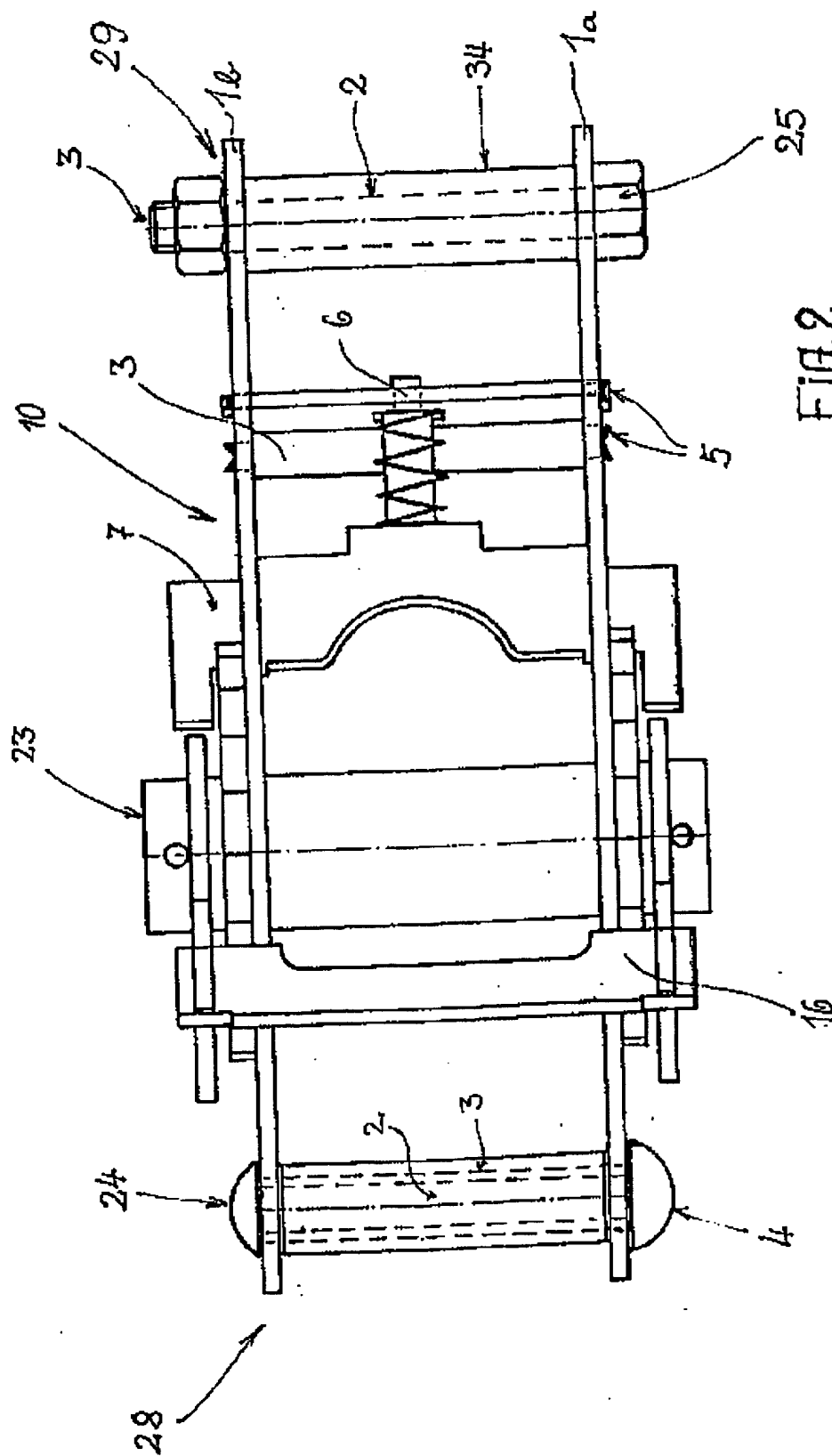


FIG. 1



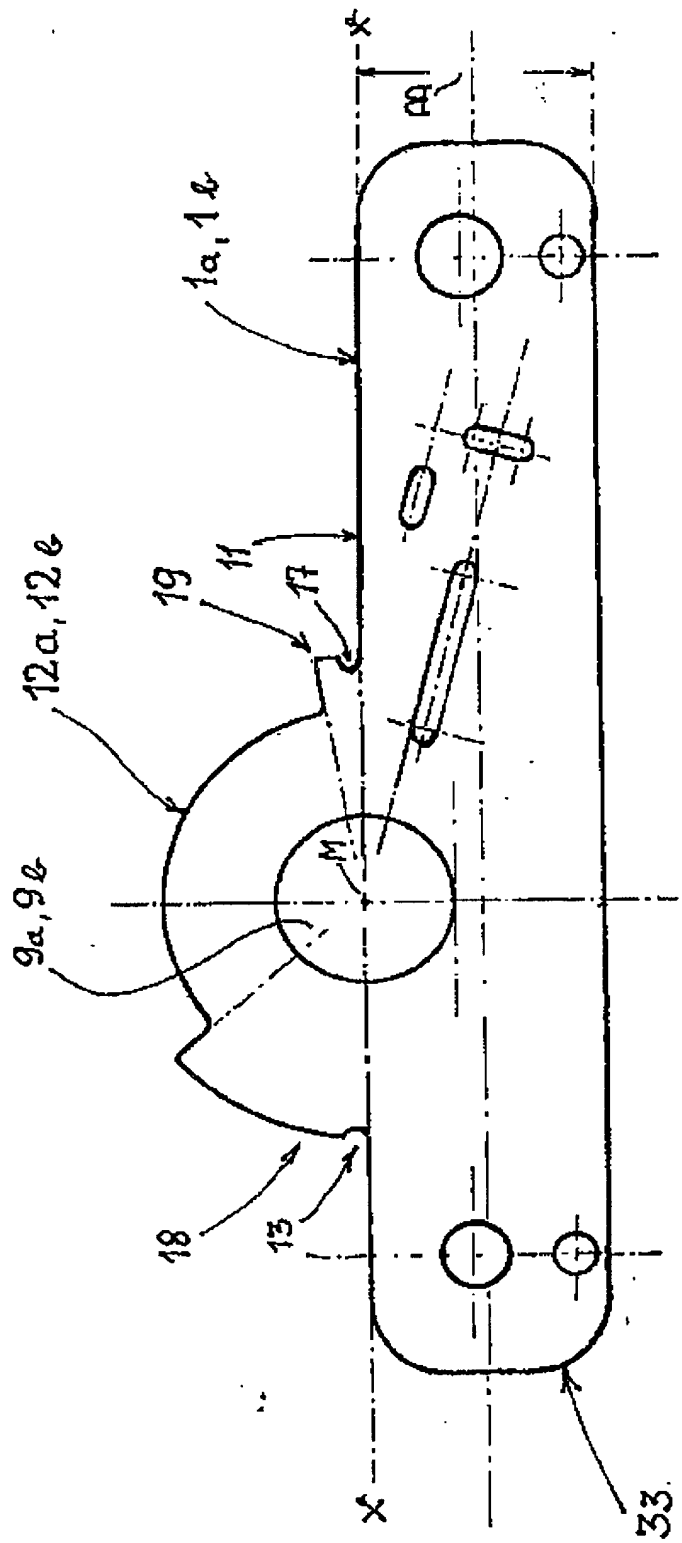


FIG. 3

FIG 4

